



Precast Block Masonry

WHY PRECAST BLOCK MASONRY?

Since a long time, bricks are being used as prime building material. Bricks are being used in thatched houses and for multi-storey buildings. Due to growing population and subsequent need of housing, there is a great demand of bricks. Shortage in supply of bricks is due to the scarcity of raw material.

If we continue to use the bricks, it will ultimately lead to the erosion of fertile land. We have to protect our resources. Apart from this, due to the scarcity of skilled labour, increasing cost of kiln fuel and demand and supply ratio of bricks, there is a need to find an alternative to the bricks.

One such alternative to the bricks is precast block masonry or concrete block. Advantage of concrete blocks is that they can be manufactured on the sites.

When a constructed product like concrete block, brick, pole, pots, etc., is produced by casting concrete in a reusable mould, then it is known as precast concrete product. Precast concrete product is produced in controlled conditions. These products can be fabricated at construction site also, thus saving transportation cost.

Concrete blocks can be manufactured at the site, which is a great advantage. We can say that precast concrete is simply concrete that is casted at any place other than where it will be used. Precast concrete blocks are used as bricks in the construction of wall, pavement block, boundary wall, partition wall, flower pots, etc.

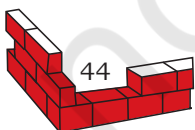
ADVANTAGES AND DISADVANTAGES OF USING PRECAST BLOCK MASONRY

Advantages

1. Superior quality of precast concrete product is produced due to better technical control practised in a manufacturing unit.
2. During precast construction, it is not necessary to provide joints.
3. The labour can be easily trained for manufacturing precast products.
4. To prepare the precast products, moulds of steel are used which have exact dimensions in all the directions. Life of these moulds is longer and can be used many times.
5. Precast concrete products can be easily given desired shape, as per the requirement, with proper finish and accuracy.
6. The moulds can be dismantled and assembled easily as per the requirement.
7. Transport and storage cost is reduced when precast concrete products are used.
8. Due to adoption of precast units, the construction and installation work of unit takes less time.
9. The amount of scaffolding and form work is reduced while adopting precast structure.

Disadvantages

1. Improper handling of precast units may lead to their damage.



2. Sometimes, joining of precast units is difficult to produce satisfactory level.
3. Specific equipment are required for lifting and moving of precast units.
4. Due to high handling and transportation cost, it becomes necessary to establish a precast units producing factory near the site in order to reduce the cost.

Material for Construction

Important materials required for this block are cement, sand and water. The mortar ratio should be 1:1 and 1:2 (cement: sand).

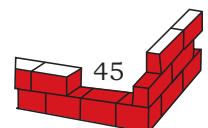
Tools and Machines Required for Block Casting

- Block making machine, hand operated with and without vibrator and electrically operated with vibrator
- Block pallets, wooden or M.S. (Mild Steel)
- Spades (*Phavdas*)
- Mortar pans (*Ghamelas*)
- Measuring boxes
- Compacting rod
- Trowel (*Thapi*)
- Painted plates for ensuring the casting dates
- Curing pipes
- Sprinklers

Block Making Machine

There are two types of block making machines.

- Hand operated machine with and without vibrator.
- Electrically operated machine with vibrator attachment. For better compacted block with more strength, electrically operated machine with vibrator attachment is preferred than the hand compacting machine. But since it



is expensive, hand compacting machines with vibrator can be used for smaller projects.

Block Pallets

- Block pallets may be made of wood or mild steel.
- Wooden pallets are generally made of sal wood and can be of different sizes. Pallet size should be about 3 mm less than the actual block size. M.S. pallets are made from 14 gauge M.S. sheet and angles welded at the bottom.
- Oiling and cleaning of block pallets should be done every week and repairs should be carried out periodically.
- Cleaning, oiling and maintenance of the block casting machine should also be carried out periodically.
- Block pallets of a special size and shape are used for producing half length blocks.

Basic Material

For manufacturing blocks, basic material required is cement, sand, shingle (coarse sand), metal, grit, dust, etc.

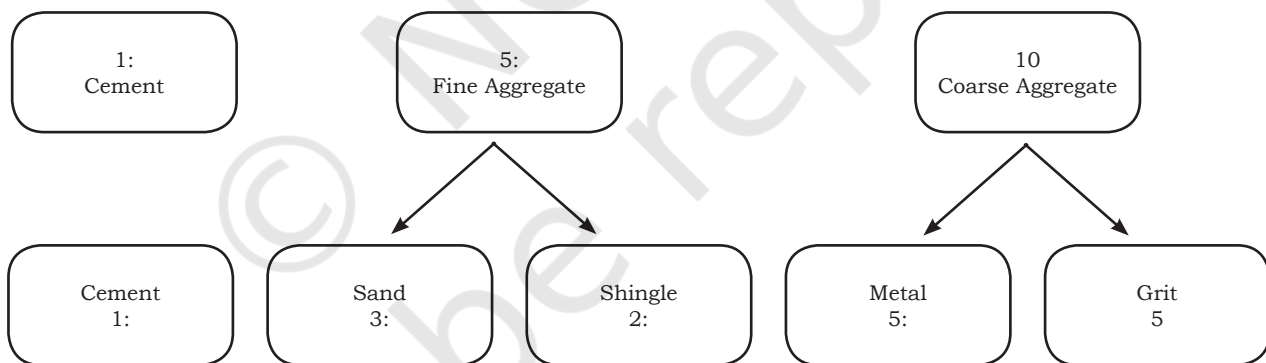
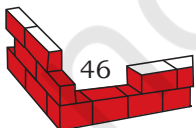


Fig. 4.1: Proportion of Material

Proportions of Material

Materials can be used in the following proportion for manufacturing non-load bearing block to get the required strength and about 35 blocks or bags of cement.



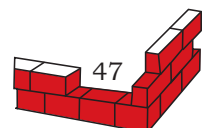
Block Manufacturing Procedure

The given procedure should be followed for manufacturing the blocks.

- Concrete block should be of sizes 30cm × 150cm × 20cm or 30cm × 10cm × 20cm.
- A platform should be prepared by laying P.C.C.
- Size of the platform should be large enough to mix at least 25 deposes (heaps).
- On this platform, deposes of the material should be dumped for each cement bag.
- Generally, the contractor mixes one depo of five to six bags of cement at a time leading to improper mixing, ultimately affecting the strength of the block.
- Mix the cement thoroughly to get a uniform dry mix.
- Then water should be added in the depo and wet mixing should be done thoroughly.
- Water cement ratio should be kept very low, as higher water cement ratio block cannot stand for a long time.
- Now, compact the concrete.
- Compaction is important for manufacturing the blocks, since the strength of the block depends on how well the block is compacted.
- To make the block fully compacted, the moulds should be filled in layers and compaction done by tamping rod or electrical vibrator.
- By using a hand operated machine, 25 strokes are required per layer; while it takes 15 seconds to compact the block completely by using electrical compaction.
- These blocks are then carried manually to the initial stacking yard for setting.
- Similarly, hollow blocks can be prepared by making certain changes.

Half Blocks and Other Size Blocks

- Generally 5 per cent half brick blocks are used in block masonry.
- These blocks are used at corners, near windows, etc.



- Making two blocks by breaking one full block is not feasible at the time of construction. Also, it can lead to an increased breakage of the blocks, resulting in wastage.
- To avoid wastage, half size block of 15cm × 15cm × 20cm or 10cm × 15cm × 20cm should be manufactured as per the requirement. Special types of pallets are used for this.

Requirement of a Quality Block

Shrinkage period

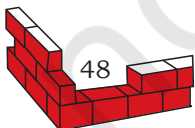
- Blocks require a minimum of 15 days curing for attaining the required strength.
- The blocks can be used after sufficient curing.
- A time gap of at least 90 days between the manufacturing date and utilisation date of the blocks is advisable. It is necessary to complete shrinkage process in the newly prepared blocks.
- Chances of developing shrinkage cracks in the masonry reduce considerably with a sufficient time gap.
- So, block manufacturing should commence at least 90 days in advance.
- Accordingly, the procurement of basic material should be done.

Curing of the blocks

Curing of the blocks should be done for minimum 28 days for getting the required strength.

Strength and testing of the concrete block

- The minimum compressive strength required for load bearing solid concrete blocks is 4N/mm^2 (40 kg/cm^2) at 28 days. However, the I.S. Code does not specify any particular limit of non-load bearing solid concrete blocks. Practical site experience indicates that the minimum compressive strength required for



these blocks should be between 2.5 to 3N/mm² (25 to 30 kg/cm²) at 28 days.

- Field tests and laboratory tests are carried out to check the quality of the block.

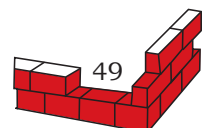
Stacking of the Blocks

The following steps are involved in stacking of the blocks.

- Freshly prepared blocks should be kept in a row, with a gap of 5 cm or 7 cm gap, for at least 24 hours, without any disturbance for initial setting of the concrete.
- After 24 hours, the pallets can be removed from the base of the block by turning the block slowly on its side.
- The block should be allowed to lie in the same position for another 12 hours before stacking it in the stacking yard. Curing of these blocks should be done at least four times a day.
- The blocks should then be carried to the stacking yard for stacking and curing.

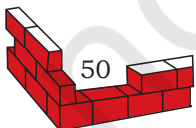
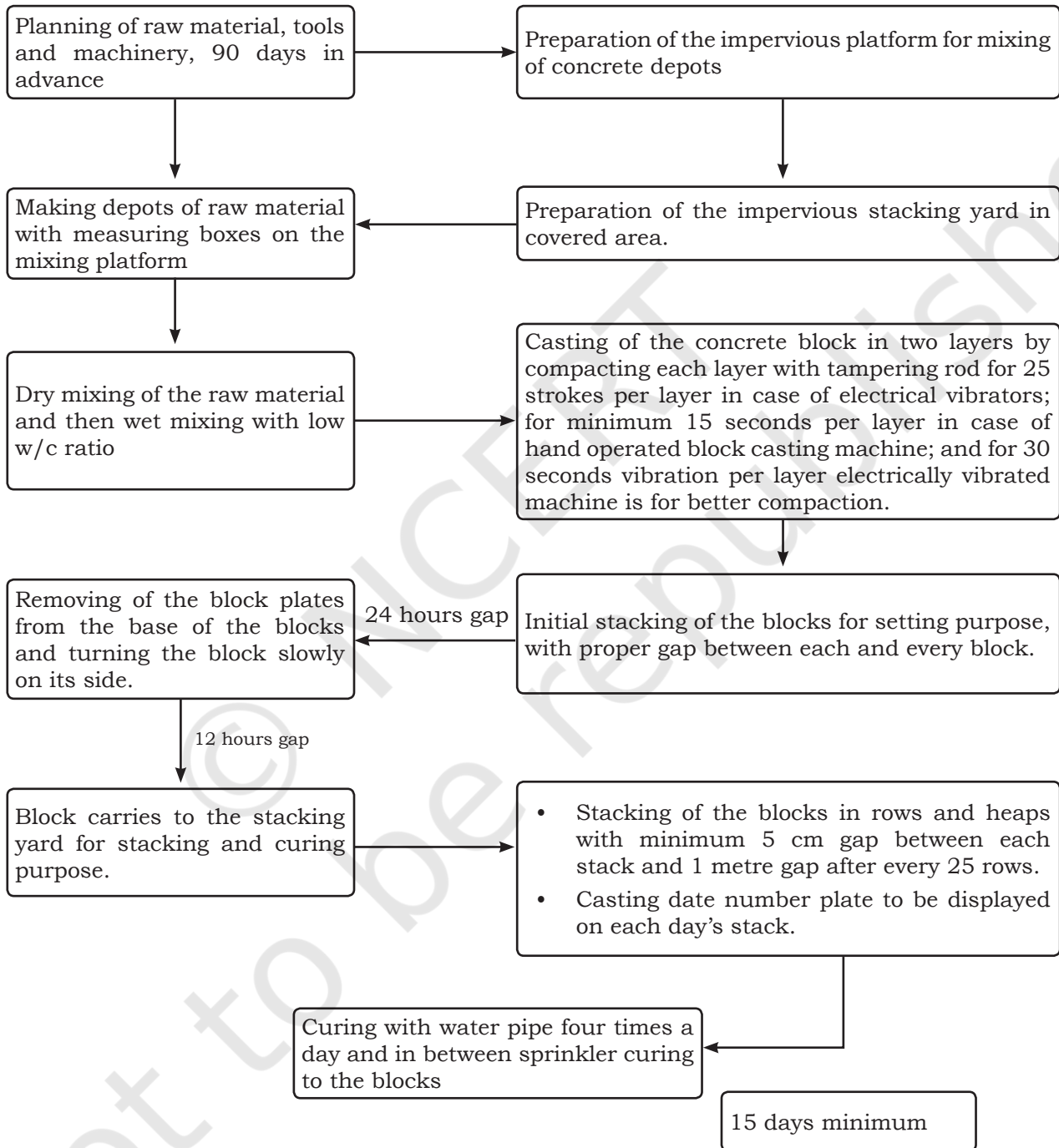
Requirements of a Good Stacking Yard

- Good stacking yard should be properly leveled with ample space with shade.
- Generally the parking place of the building or the shaded area under a big tree makes good stacking yards.
- Water connections should be provided in the stacking yard at convenient places for easy curing.
- The blocks should be stacked in rows and heaps, with a gap of 5 cm between each stack for ventilation.
- There should be a gap of 1 m after every 20–25 rows for easy lifting of the blocks.
- Each stack of block should contain six numbers of blocks placed one above the other.
- Blocks should be stacked in such a way that the edges of every individual block remain intact.



- The casting date number plate should be kept on the stack for ensuring the curing days of the blocks.

Flow chart of Block Manufacturing



Curing of the Blocks

Curing is the most important activity for the production of blocks. All efforts to produce quality blocks will be useless if curing is not done properly.

The following steps should be observed during the curing of the blocks.

- Cure the individual stack.
- Ensure that the lowermost block in the stack has soaked water.
- Generally, to finish the work quickly, the curing person waters only the top layer of the stack and the remaining layers remain uncured.
- Curing of the blocks should start immediately after stacking and it should continue for at least fifteen days after the casting date.
- Curing with a water pipe at least four times a day is essential for every block.
- In addition to pipe curing, sprinkler curing is also advisable.
- Due to sprinkler curing, the blocks remain moist all the time, resulting in an increase in the ultimate strength.
- Number plates indicating casting date should be strictly displayed every day on the stack for easy supervision of curing.

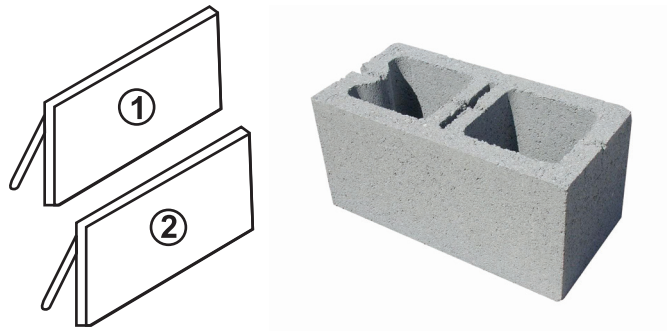


Fig. 4.2: Block mould



Fig. 4.3: Curing pipes



Fig. 4.4: Block pallet



Fig. 4.5: Block casting machine

Precast cement concrete blocks construction

Precast cement concrete blocks are prepared by the following procedure.

Manufacturing of concrete block

Mould

For manufacturing of concrete block, moulds are fabricated. These moulds should be made of mild steel plates. These moulds may be either fixed type (box with four side walls fixed at corners and top and bottom open) or split type.

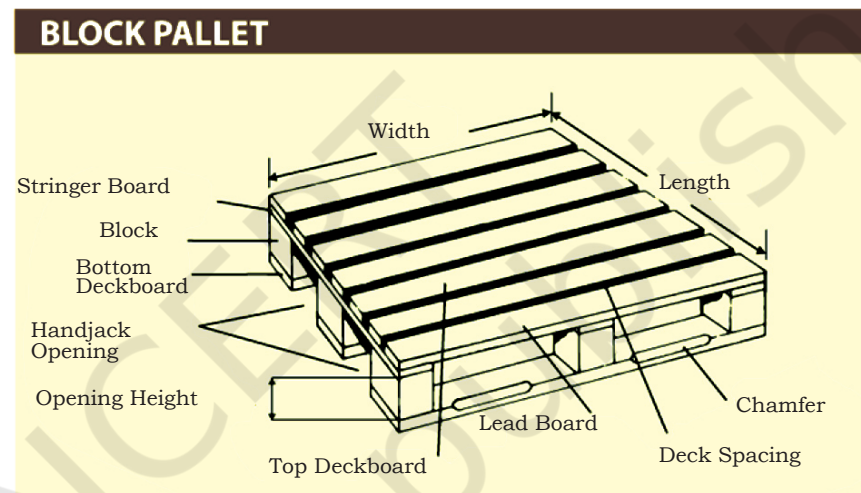


Fig. 4.6: Machinery used for precast concrete block making



Fig. 4.7: Block making machine

When the manual compaction of concrete is done, the mould may be fixed type or split type. Whereas when compression is done with surface vibrator, then split type moulds should be used.

After filling the mould with concrete, compaction is done for 5 to 10 minutes, demoulding should be done after 10 minutes of

compaction only. In case of fixed type of moulds, demoulding is done by opening one side handle and pressing down the blocks. Whereas, in case of split type moulds, the side of mould should be opened first and other sides and the partition plates shall be removed subsequently.

The block should be kept properly after demoulding till it gets hardened properly.



Fig. 4.8: Steps in moulding of concrete block

Proportion

For preparation of mixture, standard proportion of cement, fine aggregate and coarse aggregate in the ratio of 1:5:10 is generally recommended. It may vary as per specific type of product. Proper compaction of concrete, water cement ratio, workability of the mixture and maximum strength are important aspects of mixture preparation.

Casting

Concrete mixer should be used for mixture preparation. Water cement ratio should be minimum. After mixing the mixture, the concrete should be poured in moulds

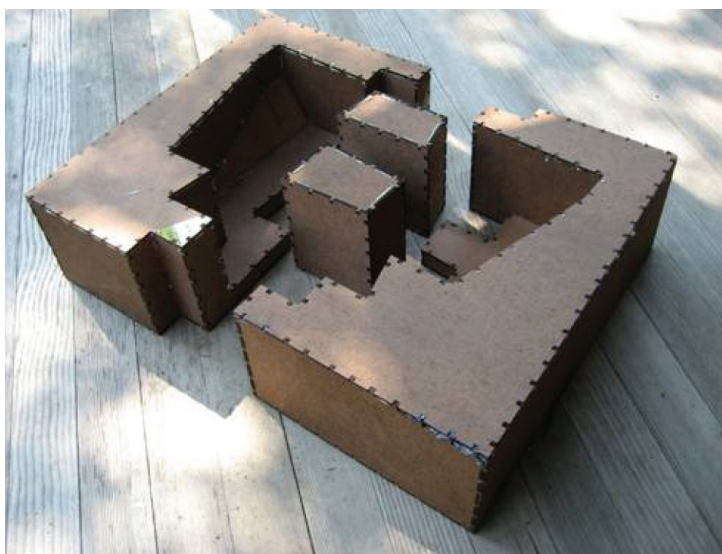


Fig. 4.9: Concrete Block Mould



Fig. 4.10: Curing Tank For Concrete Block

with a metal basket or a pot. Small immersion vibrator or table vibrator should be used for compaction of concrete. Demoulding should be done after 10 minutes as told earlier.

Curing

In the process of curing, blocks are stored in the water tank. Curing of block is done for minimum 14 days to get good strength.

Drying

Blocks are dried for two to four weeks after curing. Drying is done to reduce shrinkage, if any, in the block.

The blocks shall be allowed to complete their initial shrinkage before they are laid in a wall.

Dimensions

As per construction requirements, blocks or units in different sizes and shapes are manufactured. Dimensions of concrete block may be kept length, height and width wise.

The nominal dimensions of concrete block is, as follows:

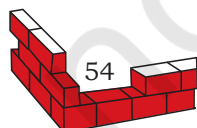
Length: 400, 500 or 600 mm

Height: 200 or 100 mm

Width: 50, 75, 100, 200, 250 or 300 mm in addition, block shall be manufactured in half lengths of 200, 250 or 300 mm to correspond to the full lengths.

Tolerances

A provision for tolerance is also kept in length, height and width wise of unit. About +5 mm lengthwise, +3 mm for height and width should be kept as per tolerance while casting the product.



Density

The mechanical properties of concrete are highly influenced by its density. A denser concrete generally provides higher strength and fewer amount of voids and porosity. Block density of 1600 kg/m^3 must be ensured.

Laying of Precast Concrete Blocks to construct a Wall

Construction of masonry

Hollow bricks are used in foundation and basement masonry whereas solid bricks are used for top foundation for single storied buildings. Hollow blocks are filled with sand for stability. Solid concrete block is used in foundation, plint and basement wall in two storied buildings. When hollow bricks are used, then their hollow parts should be filled with cement concrete having proportion of 1:3:6 with 12.5 mm size aggregate.



Fig. 4.11: Concrete Block Wall

Wetting of Blocks

As concrete blocks are prepared with curing process, they need not be wetted during laying in the walls. However in special condition, to prevent absorption of water from the mortar, top and side of the block may be little wetted.

Laying

First course of blocks should be installed below floor level and inside the foundation trench. Then first line of blocks will be fixed on top with a layer of mortar mix. Mortar will be spreaded along the sides of the blocks. With the help of trowel, excess mortar should be removed. Repeat until the first course has been installed. Check the course with a level. Precast half length closer should be used instead of cutting from

full size blocks. Special care should be taken to avoid damaging of edges of block.

Provision for Door and Window Frames

For door and window opening, a course of solid concrete block must be placed. A 10 cm thick precast concrete may also be laid below windows. 20 cm provision should be done in concrete block laying below door and window.

Intersecting Walls

When two walls cross each other at a point, they are referred as intersecting walls. During the intersection of walls, a provision of 20 mm vertical spacing is left in the first wall. Courses of both intersecting walls are laid up at the same time.



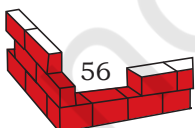
Fig. 4.12: Concrete block wall in house construction

Provisions for roof

Solid blocks should be used below the roof slab. A layer of cement and coarse sand mortar, in standard proportion, should be placed at the top of course. It should be covered with a thick coat of white wash so that the movement of slab is not affected.

Piers

Solid blocks are used for making the top course of block in the pier. Hollow blocks are not recommended for isolated piers. Holdfast must be inserted into joints of masonry for better stability. Use of cement and coarse sand mortar in 1:3 proportion must be prepared while laying the blocks.



Various parts like holes, sleeves, chases, opening, etc., of desired size and shape should be developed in the masonry with special blocks. It should be used while fixing pipes, service lines, passage of water, etc.

Finishes

The process of external wall plastering is known as Rendering. Rendering should be avoided when the walls are wet. Joints for plastering or pointing should be raked upto a depth of 12 mm. Joints on internal faces, should be raked for plastering. When the internal faces are not plastered, then the joints should be finished with flush or pointed flush as per the need.

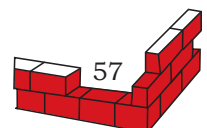
Precautions during precast concrete construction

DOs

1. For quality control, three blocks out of every 1000 may be tested for compressive strength.
2. Through stones should be provided at regular intervals of 1.5 meter height.
3. Natural bed of stone should be always perpendicular to the loading.
4. Mortar should be consumed within 30 minutes of adding water to the mortar mix.

DON'Ts

1. Fine sand should not be used for block production.
2. Wetting of blocks is not necessary, they should be laid dry. Only in hot weather, the blocks should be wetted on the surface to reduce their suction of moisture from the mortar.
3. Rounded stones should not be used for masonry.
4. Don't make holes in the masonry for scaffolding. Only double scaffolding should be used.
5. Bonding of the wall should not be filled with small stone pieces.



Practical Exercise

1. Visit the precast concrete block construction site, observe the activities, then, prepare and submit a report of your observation.
2. Calculate the number of precast concrete blocks required to prepare a wall of 20cm thickness 4m height and 6m length.

Check Your Progress

A. Short Answer Questions

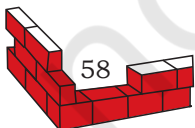
1. Give the advantages and disadvantages of precast concrete block.
2. Draw a neat diagram of the concrete block mould.
3. Mention the dimensions for precast concrete block.
4. Write down the procedure of laying concrete blocks in the construction of wall.
5. Why the precast concrete blocks are used in construction?

B. Fill in the blanks

1. _____ is a construction product produced by casting concrete in a mould or form.
2. Cement mortar used in the construction of concrete block wall construction is of _____ ratio.
3. The top course of block in the pier shall be built in _____ blocks.
4. The concrete block is cured for _____ days.
5. _____ and _____ are carried out to check the quality of the block.

C. Multiple Choice Questions

1. Precast concrete is a construction product produced by casting concrete in a _____.
(a) reusable mould (b) plastic mould
(c) sand mould (d) None of these
2. Block making machine is _____ operated.
(a) manually (b) motor
(c) electrically (d) All of the above
3. Curing of blocks should be done for minimum _____.
(a) 07 days (b) 15 days
(c) 28 days (d) 35 days



4. Ideal mixture for mix for concrete block is _____.
(a) 1:4:8 (b) 1:5:10
(c) 1:6:10 (d) 1:8:16
5. Maximum block density of hollow block is _____.
(a) 1000 kg/m³ (b) 1400 kg/m³
(c) 1600 kg/m³ (d) 2000 kg/m³

D. Write a paragraph on the following

1. The manufacturing process of precast concrete block.
2. The tools used in precast concrete block construction with the help of diagrams.

